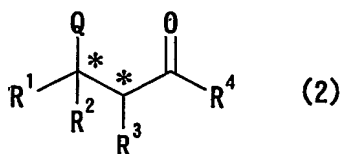


## CLAIMS

1. A process for producing an optically active  $\beta$ -amino acid derivative of the formula (2):



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wherein  $\text{R}^1$  and  $\text{R}^2$  are each independently a hydrogen atom, a hydrocarbon group which may be substituted, an acyl group which may be substituted, an alkoxycarbonyl group which may be substituted, an aryloxycarbonyl group which may be substituted, an aralkyloxycarbonyl group which may be substituted, an alkoxy group which may be substituted, an aryloxy group which may be substituted, an aralkyloxy group which may be substituted and a heterocyclic group which may be substituted;

$\text{R}^3$  is a hydrogen atom, an alkoxy group which may be substituted, an aryloxy group which may be substituted, an aralkyloxy group which may be substituted, a hydroxy group and a hydrocarbon group which may be substituted;

$\text{R}^4$  is an alkoxy group which may be substituted, an aryloxy group which may be substituted, an aralkyloxy group which may be substituted, a hydroxy group,  $-\text{NR}^a\text{R}^b$  [wherein  $\text{R}^a$  and  $\text{R}^b$  are each independently a hydrogen atom, a hydrocarbon group which may be substituted and an acyl group which may be substituted,  $-\text{SO}_2\text{A}^1$  (wherein  $\text{A}^1$  is a hydrocarbon group which may be substituted or a substituted amino group), or  $-\text{COOR}^c$  ( $\text{R}^c$  is a hydrocarbon group which may be substituted)] or a heterocyclic group which may be substituted, and  $\text{R}^1$  and  $\text{R}^2$ , or  $\text{R}^2$  and  $\text{R}^3$  each may combine to form a ring; with the proviso that when  $\text{R}^1 = \text{R}^2$ ,

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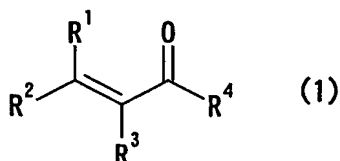
then  $R^3$  is a hydrocarbon group which may be substituted;

Q is a group formed by removing a hydrogen atom from an amine; and

\* indicates an asymmetric carbon atom;

5 or a salt thereof,

which comprises reacting an  $\alpha,\beta$ -unsaturated carboxylic acid derivative of the formula (1):



wherein  $R^1$  to  $R^4$  are each the same as mentioned above, with an  
 10 amine or a salt thereof, in the presence of a chiral catalyst  
 and in the presence or absence of an acid.

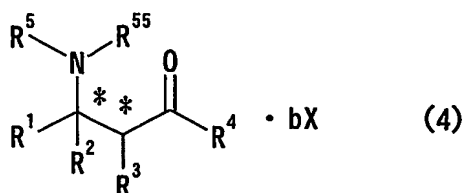
2. The process according to claim 1, wherein said amine  
 or acid salt thereof is a compound of the formula (3):

15  $R^5-NH-R^{55} \cdot aX \quad (3)$

wherein  $R^5$  and  $R^{55}$  are each independently a hydrogen atom, a  
 hydrocarbon group which may be substituted, an alkoxy group  
 which may be substituted, an aryloxy group which may be  
 substituted or an aralkyloxy group which may be substituted;

20 X is an acid; and a is 0 or 1.

3. The process according to claim 1, wherein said optically  
 active  $\beta$ -amino acid or salt thereof is a compound of the formula  
 (4):



wherein  $R^1$  and  $R^2$  are each independently a hydrogen atom, a hydrocarbon group which may be substituted, an acyl group which may be substituted, an alkoxycarbonyl group which may be substituted, an aryloxycarbonyl group which may be substituted, an aralkyloxycarbonyl group which may be substituted, an alkoxy group which may be substituted, an aryloxy group which may be substituted, an aralkyloxy group which may be substituted or a heterocyclic group which may be substituted;

$R^3$  is a hydrogen atom, an alkoxy group which may be substituted, an aryloxy group which may be substituted, an aralkyloxy group which may be substituted, a hydroxy group or a hydrocarbon group which may be substituted;

$R^4$  is an alkoxy group which may be substituted, an aryloxy group which may be substituted, an aralkyloxy group which may be substituted, a hydroxy group,  $-NR^aR^b$  [wherein  $R^a$  and  $R^b$  are each independently a hydrogen atom, a hydrocarbon group which may be substituted, an acyl group which may be substituted,  $-SO_2A^1$  (wherein  $A^1$  is a hydrocarbon group which may be substituted or a substituted amino group), or  $-COOR^c$  ( $R^c$  is a hydrocarbon group which may be substituted)] or a heterocyclic group which may be substituted;

$R^5$  and  $R^{55}$  are each independently a hydrogen atom, a hydrocarbon group which may be substituted, an alkoxy group which may be substituted, an aryloxy group which may be substituted or an aralkyloxy group which may be substituted;

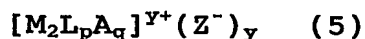
b is 0 or 1;

X is an acid;

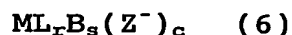
\* indicates an asymmetric carbon; or

R<sup>1</sup> and R<sup>2</sup>, or R<sup>2</sup> and R<sup>3</sup> may combine to form a ring, with  
 5 the proviso that when R<sup>1</sup> = R<sup>2</sup>, then R<sup>3</sup> is a hydrocarbon group  
 which may be substituted.

4. The process according to claim 1, wherein the chiral  
 catalyst is a chiral transition-metal complex of the formula  
 10 (5):

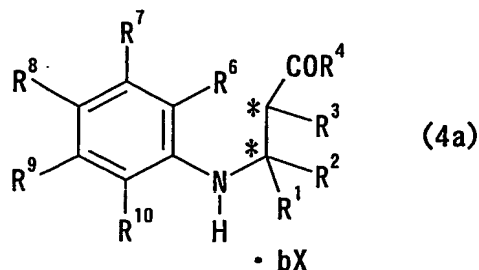


wherein L is a chiral ligand; Z<sup>-</sup> is a counter anion; A is an  
 anionic ligand selected from the group consisting of a hydroxy  
 group, an amide group, an alkoxy group and a halogen atom; M  
 15 is a transition metal; y is 0 or 2; q is 2; p is 2 or 4, or of  
 the formula (6):



wherein L is a chiral ligand; Z<sup>-</sup> is a counter anion; B is a water  
 molecule or a neutral ligand; M is a transition metal; r is 1  
 20 or 2; s is 0, 1, 2, 4 or 6; c is 0, 1 or 2.

5. A process for producing an optically active β-amino  
 acid derivative of the formula (4a):



25 wherein R<sup>1</sup> and R<sup>2</sup> are each independently a hydrogen atom, a

hydrocarbon group which may be substituted, an acyl group which may be substituted, an alkoxycarbonyl group which may be substituted, an aryloxy carbonyl group which may be substituted, an aralkyloxy carbonyl group which may be substituted, an alkoxy group which may be substituted, an aryloxy group which may be substituted, an aralkyloxy group which may be substituted, or a heterocyclic group which may be substituted;

$R^3$  is a hydrogen atom, an alkoxy group which may be substituted, an aryloxy group which may be substituted, an aralkyloxy group which may be substituted, a hydroxy group, or a hydrocarbon group which may be substituted;

$R^4$  is an alkoxy group which may be substituted, an aryloxy group which may be substituted, an aralkyloxy group which may be substituted, a hydroxy group,  $-NR^aR^b$  [wherein  $R^a$  and  $R^b$  are each independently a hydrogen atom, a hydrocarbon group which may be substituted, an acyl group which may be substituted,  $-SO_2A^1$  (wherein  $A^1$  is a hydrocarbon group which may be substituted or a substituted amino group), or  $-COOR^c$  ( $R^c$  is a hydrocarbon group which may be substituted)], or a heterocyclic group which may be substituted; or

$R^1$  and  $R^2$ , or  $R^2$  and  $R^3$  may combine to form a ring, with the proviso that when  $R^1 = R^2$ , then  $R^3$  is a hydrocarbon group which may be substituted,

$R^6$  to  $R^{10}$  are each independently a hydrogen atom, a hydrocarbon group which may be substituted, a halogen atom, a heterocyclic group which may be substituted, an alkoxy group which may be substituted, an aralkyloxy group which may be substituted, an aryloxy group which may be substituted, an acyl group which may be substituted, an acyloxy group, an

alkoxycarbonyl group which may be substituted, an  
 aryloxycarbonyl group which may be substituted, an  
 aralkyloxycarbonyl group which may be substituted, an  
 alkylenedioxy group, a hydroxy group, a nitro group or an amino  
 5 group which may be substituted; or

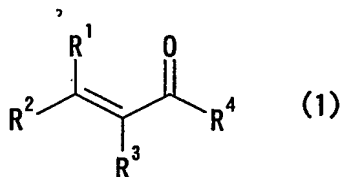
$R^6$  and  $R^7$ ,  $R^7$  and  $R^8$ ,  $R^8$  and  $R^9$ , or  $R^9$  and  $R^{10}$  each may combine  
 to form a fused ring, with the proviso that at least one of  $R^6$   
 to  $R^{10}$  is a halogenated hydrocarbon group;

X is an acid;

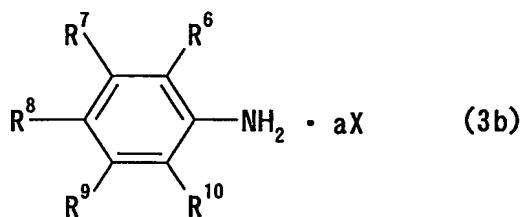
10 b is 0 or 1; and

\* indicates an asymmetric carbon; or  
 a salt thereof,

which comprises reacting an  $\alpha,\beta$ -unsaturated carboxylic acid  
 derivative of the formula (1):

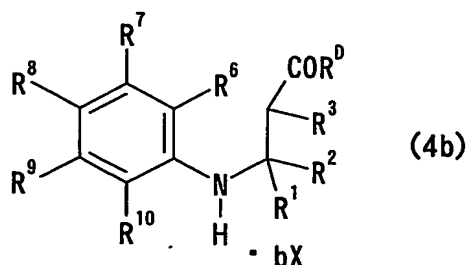


wherein  $R^1$  to  $R^4$  are each the same as mentioned above, with a  
 primary amine of the formula (3b):



wherein a is 0 or 1; and  $R^6$  to  $R^{10}$ , and X are each the same as  
 20 mentioned above, or a salt thereof in the presence or absence  
 of an acid and in the presence of a chiral catalyst.

6. A compound of the formula (4b):



wherein  $R^1$  and  $R^2$  are each independently a hydrogen atom, a hydrocarbon group which may be substituted, an acyl group which may be substituted, an alkoxycarbonyl group which may be substituted, an aryloxycarbonyl group which may be substituted, an aralkyloxycarbonyl group which may be substituted, an alkoxy group which may be substituted, an aryloxy group which may be substituted, an aralkyloxy group which may be substituted or a heterocyclic group which may be substituted;

$R^3$  is a hydrogen atom, an alkoxy group which may be substituted, an aryloxy group which may be substituted, an aralkyloxy group which may be substituted, a hydroxy group or a hydrocarbon group which may be substituted; or

$R^1$  and  $R^2$ , or  $R^2$  and  $R^3$  each may combine to form a ring;

$R^6$  to  $R^{10}$  are each independently a hydrogen atom, a hydrocarbon group which may be substituted, a halogen atom, a heterocyclic group which may be substituted, an alkoxy group which may be substituted, an aralkyloxy group which may be substituted, an aryloxy group which may be substituted, an acyl group which may be substituted, an acyloxy group, an alkoxycarbonyl group which may be substituted, an aryloxycarbonyl group which may be substituted, an aralkyloxycarbonyl group which may be substituted, an alkylenedioxy group, a hydroxy group, a nitro group or an amino group which may be substituted; or

$R^6$  and  $R^7$ ,  $R^7$  and  $R^8$ ,  $R^8$  and  $R^9$ , or  $R^9$  and  $R^{10}$  each may combine to form a fused ring, with the proviso that at least one of  $R^6$  to  $R^{10}$  is a halogenated hydrocarbon group;

X is an acid;

5        b is 0 or 1; and

$R^D$  is a heterocyclic group which may be substituted.